

Nevada.—Winnemucca, 29th.
New Hampshire.—Mount Washington, 25th.
New York.—Albany, 1st, 8th, 31st; Setauket, 7th, 31st;
New York City, 15th, 31st; Palmyra, 31st.
North Carolina.—Wilmington and Charlotte, 4th; Weldon,
 31st.
Ohio.—North Lewisburg, 1st; Cleveland, 13th, 14th, 31st;
Cincinnati, 17th; Portsmouth, 17th, 31st; Columbus, West
 Milton, and Yellow Springs, 31st.
Pennsylvania.—Philadelphia, 6th; Franklin, 30th, 31st;
 Zionsville, 31st.
Rhode Island.—Block Island, 7th.
Tennessee.—Nashville and Milan, 28th.
Virginia.—Accotink, 5th; Variety Mills, 5th, 6th, 29th, 30th;
Lynchburg, 5th, 29th, 30th, 31st; Norfolk and Cape Henry,
 6th; Chincoteague, 6th, 29th, 30th.
Washington Territory.—Walla Walla, 19th, 27th to 31st;
Port Angeles, 25th; Pysht, 26th.

Table of excessive and greatest monthly precipitation for December, 1886.

Station.	Specially heavy.		Largest monthly.	Amount.	Station.	Specially heavy.		Largest monthly.	Amount.
	Date.	Amt.				Date.	Amt.		
British Columbia.					Oregon—Con.				
New Westminster.				15.89	Mount Angel.	8	2.10	12.45	
California.					Bandon.	8	2.05	11.97	
Fort Gaston.	10, 11	3.12	15.81		Do.	27, 28	2.42		
Do.	27, 28	3.70			Portland.	25, 26	2.20	11.52	
Delta.				8.81	East Portland.			11.34	
Emigrant Gap.				7.40	Albany.			10.31	
Colfax.				6.12	Eola.			9.08	
Conestoga.					Roseburg.			7.30	
Voluntown.				6.15	Fort Klammath.			6.55	
Florida.					Rhode Island.				6.70
Pensacola.	10, 11	2.37			Tennessee.				
Sanford.	10, 11	2.18			Greenoville.	5	3.00		
Alva.	31	2.00			Jonesborough.	5	3.00		
Illinois.					Parkeville.	6	2.00		
Marengo.	23	2.00			Washington Ter.				
Anna.	23, 24	2.03			Neah Bay.	2, 3	3.65	30.70	
Louisiana.					Do.	15, 16, 17	3.10		
Grand Coteau.	28	2.12			Do.	27, 28	3.60		
Maine.					Do.	30, 31	2.05		
Eastport.	25	2.17	6.51		Do.	12, 13	4.02	25.84	
Orono.			6.38		Do.	15, 16	2.56		
Massachusetts.					Do.	27, 28	3.17		
New Bedford.				6.92	Do.	31	2.38		
North Carolina.					Fort Canby.	6, 7	2.79	17.35	
Charlotte.	4, 5, 6	2.06	6.26		Do.	31	2.58		
Flat Rock.	5	3.95			Olympia.	31	2.50	13.38	
Hatteras.		2.65			Bainbridge Isl'd.			11.15	
Oregon.					Tacoma.	31	2.82	11.09	
Astoria.	2, 3	2.02	16.89		Walla Walla.			7.86	
Do.	20, 21	2.12			Port Angeles.			7.71	
Gardiner.	8	2.65	13.97						
Do.	28, 29	3.04							

WINDS.

The most frequent directions of the wind during December, 1886, are shown on chart ii by the arrows flying with the wind; they are also given in the table of miscellaneous meteorological data. In the Missouri and upper Mississippi valleys, Dakota, and Minnesota, the wind blew mostly from the north or northwest; in the Lake regions the prevailing direction was west; in New England and the middle Atlantic states, northwest. In other portions of the country the winds were variable.

HIGH WINDS.

[In miles per hour.]

Wind-velocities of fifty or more miles per hour were recorded during the month, as follows:

Mount Washington, New Hampshire, 84, nw., 1st; 84, nw., 2d; 83, w., 3d; 89, w., 4th; 54, se., 7th; 78, nw., 8th; 76, nw., 9th; 99, nw., 10th; 98, nw., 11th; 54, s., 13th; 84, w., 14th; 71, sw., 15th; 92, nw., 16th; 94, nw., 17th; 50, sw., 18th; 70, w., 19th; 78, w., 21st; 56, sw., 23d; 64, sw., 24th; 100, nw., 25th; 87, w., 27th; 77, nw., 28th; 78, w., 29th.

Pike's Peak, Colorado, 54, w. and nw., 1st; 52, nw., 2d; 58, n., 3d; 66, w., 9th; 74, n., 14th; 58, nw., 15th; 72, nw., 16th; 76, w., 20th; 72, nw., 22d; 70, n., 23d; 76, w., 24th; 50, w., 25th; 80, w., 26th; 72, nw., 27th; 56, nw., 28th; 64, w., 29th; 58, w., 30th; 56, n., 31st.

Cape Mendocino, California, 50, se., 5th; 76, se., 6th; 72, se., 7th; 60, se., 8th; 64, se., 10th; 72, se., 11th; 52, se., 12th; 65, se., 27th; 88, s., 28th; 70, se., 29th; 56, se., 30th; 52, se., 31st.

Fort Canby, Washington Territory, 50, se., 7th; 50, s., 12th; 50, s., 13th; 50, se., 15th; 58, s., 28th.

Block Island, Rhode Island, 51, ne., 6th.

Chincoteague, Virginia, 52, nw., 6th.

Nantucket, Massachusetts, 50, ne., 7th.

Tatoosh Island, Washington Territory, 51, se., 12th.

Fort Assinaboine, Montana, 52, s., 13th.

Fort Maginnis, Montana, 52, w., 13th; 54, w., 19th.

Valentine, Nebraska, 56, nw., 14th.

Fort Elliott, Texas, 52, nw., 14th.

Sandusky, Ohio, 52, n., 15th.

Fort Totten, Dakota, 50, sw., 20th.

Fort Buford, Dakota, 50, w., 20th.

Kitty Hawk, North Carolina, 52 ne., 25th.

INLAND NAVIGATION.

STATE OF WATER IN RIVERS AND HARBORS.

Heavy ice formed on the Mississippi River in the vicinity of Cairo, Illinois, on the 1st. Owing to the low stage of water in the river, and its consequent liability to freeze quickly, the Anchor line of steamers went into winter quarters as they arrived at this port. On the 4th the river had become covered with heavy ice from the mouth of the Ohio to Saint Louis. At Bird Point, Missouri, the junction of the Mississippi and Ohio Rivers, the ice had been forced up to such a height around the "cradles" that the transfer steamers were unable to reach their wharves. Owing to the low stage of water in the river several steamers were aground a short distance above Cairo on the same date; on the 14th the river was reported by steamboat men to be lower than at any other time during the past five years, and many old wrecks were visible that had not been seen since their destruction. Heavy floating ice passed down the Ohio and Mississippi Rivers at Cairo every day of the month; on the 30th it became heavy enough to impede navigation. At Saint Louis, Missouri, river navigation was suspended on the 1st on account of low water and floating ice; during the afternoon of the same day the Mississippi River was gorged with ice at Warsaw, Illinois, and the Illinois River at Beardstown, Illinois. The observer at Saint Louis, Missouri, states that the Mississippi River was lower during the first five days of the month than at any other time since river observations have been made; after the 6th it began rising and on the 19th was 7.9 feet above low-water mark. On the 6th the ice gorged at South Saint Louis, causing a rise of five feet at points immediately above; the gorge did not break until 4 p. m. of the 10th, and resulted in a rapid decline in the river at this point. Large quantities of ice passed down the river every day of the month. At Dubuque, Iowa, very low temperatures prevailed during the 1st, 2d, and 3d, and ice began forming rapidly on the Mississippi River at Dubuque, on the 1st; on the 3d the river was covered with ice of such thickness as to allow vehicles to cross from one side to the other.

Navigation on the Hudson River became practically closed for the season about the 6th; on that date the ice in the river, from Rondout northward, ranged from two to six inches in thickness and ice men were already at work filling their ice-houses. All the freight and passenger steamers plying between New York City and points north of Poughkeepsie went into winter quarters about the 4th. The propeller "Newburg" left New York City on the 27th for Newburg, but became fast in the ice when two miles north of Cold Spring, New York, and was obliged to return.

Duluth, Minnesota: the water in the harbor became frozen over on the 5th and ice began forming along the lake shore on the same date. A field of ice was observed on the 16th near the south shore; it continued to extend until the 24th, when it was within a mile of the north shore, and at the end of the month had nearly covered the lake.

Escanaba, Michigan: the steam tug "Swain," having in tow the schooner "Swallow," left port on the morning of the 6th for Detroit. This was the last vessel to leave port this season and navigation was practically closed on that date.

Milwaukee, Wisconsin: there was more ice in Milwaukee Bay at the end of the month than there has been in any December during the past ten years; on the 31st three propellers were fast in the ice for several hours.

Erie, Pennsylvania: the propeller "Philadelphia," of the Anchor Line, reached this port, by forcing her way through the ice, on the morning of the 7th; this was the last vessel to arrive at this port, and navigation was closed for the season.

Sandusky, Ohio: Sandusky Bay became frozen over on the 1st and navigation was closed for the season. All steamers at this port have gone into winter quarters.

Little Rock, Arkansas: the steamer "Ella" arrived on the 18th, but, owing to the low stage of the water in the Arkansas River, was unable to depart. On the 27th the river was navigable for small boats only.

Louisville, Kentucky: on the 22d and 23d the Ohio River was filled with heavy floating ice which impeded the progress of steamboats.

Leavenworth, Kansas: the Missouri River at this point was frozen over from the 4th to 10th and from the 27th to 31st; on all other days of the month it was filled with heavy floating ice.

Rochester, New York: the Genesee River became frozen on the 2d, closing navigation for the season.

Philadelphia, Pennsylvania: ice formed rapidly on the Delaware and Schuylkill rivers during the 5th, making navigation difficult. Navigation on the Schuylkill River closed this season unusually early and a large number of canal boats were ice bound.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for December, 1886, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, December, 1886.
[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29.9	1 to 5	10.5	28 to 31	4.0	6.5
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22.0	24 to 27	1.6	7, 8	0.8	0.8
Little Rock, Arkansas.....	23.0	1	3.3	21, 22, 23	1.3	2.0
<i>Missouri River:</i>						
Yankton, Dakota.....	24.0					
Omaha, Nebraska.....	18.0					
Leavenworth, Kansas.....	20.0	12	6.0	18	3.1	2.9
<i>Mississippi River:</i>						
Saint Paul, Minnesota.....	14.5					
La Crosse, Wisconsin.....	24.0					
Dubuque, Iowa.....	16.0	5	3.2	1	1.7	1.5
Davenport, Iowa.....	15.0					
Keokuk, Iowa.....	14.0					
Saint Louis, Missouri.....	32.0	19	7.9	14, 5	7.0	7.8
St. Louis, Missouri.....	40.0	1	23.8	17, 18	9.2	14.6
Memphis, Tennessee.....	34.0	3	18.4	20	6.6	11.8
Vicksburg, Mississippi.....	41.0	8, 9	20.5	25	6.3	14.2
New Orleans, Louisiana.....	13.0	9	5.1	26, 28	2.0	3.1
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22.0	26	12.3	11, 12	2.8	9.5
Cincinnati, Ohio.....	50.0	29	27.2	14, 15	10.0	17.3
Louisville, Kentucky.....	25.0	1	11.4	15	5.6	5.8
<i>Cumberland River:</i>						
Nashville, Tennessee.....	40.0	23	20.8	12, 13	4.7	16.1
<i>Tennessee River:</i>						
Knoxville, Tennessee.....		14	8.0	8	2.3	5.7
Chattanooga, Tennessee.....	33.0	22	16.6	12	4.0	12.6
<i>Monongahela River:</i>						
Pittsburg, Pennsylvania.....	29.0	26	12.3	11, 12	2.8	9.5
<i>Savannah River:</i>						
Augusta, Georgia.....	32.0	13	11.5	4, 5	6.5	5.0
<i>Mobile River:</i>						
Mobile, Alabama.....		4	16.8	16	15.1	1.7
<i>Sacramento River:</i>						
Sacramento, California.....		10, 11	10.9	1 to 7	7.8	3.1
<i>Willamette River:</i>						
Portland, Oregon.....		28, 29, 30	10.0	6	0.1	9.9
<i>Colorado River:</i>						
Yuma, Arizona.....		18 to 22, 25, 26, 27	15.6	3, 4, 5	14.9	0.7

• River frozen. † Approximated.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Mount Washington, New Hampshire: a faint auroral light was observed from 9.50 to 11.30 p. m. of the 17th; it was accompanied by no streamers or other distinctive features.

Fort Buford, Dakota: an auroral light of a pale white color appeared on the northern horizon at 9.28 p. m. of the 22d; it extended from northwest to northeast and to an altitude of about 15°. Between 10.15 and 10.25 p. m. a few white streamers, extending to an altitude of 27°, were visible in the north. The aurora was obscured by clouds at 11.45 p. m.

Saint Vincent, Minnesota: an aurora was observed in the north at 11 p. m. of the 25th; it first appeared in the form of a low line of light extending from north to northeast, and having an altitude of about three degrees. At 11.15 p. m. the light had become wider and white beams shot upward from different parts of the base. At the base the colors increased in intensity, showing successively white, lemon, orange, and red, the last-named color was the last to disappear, remaining visible until the early morning of the 26th.

Bismarck, Dakota: an auroral arch extending from azimuth 150° to 225° and to an altitude of 30° was seen at 12.45 a. m. of the 26th. The maximum intensity occurred at 1.15 a. m. when beams of bright light extended to an altitude of 40°. The display ended at 7.45 a. m.

Marquette, Michigan: an aurora was visible from 9.15 to 10.20 p. m. of the 29th; several streamers extended to a height of 40°.

Other auroral displays were observed during the month, as follows:

- 1st.—Escanaba, Michigan; Green Bay, Wisconsin; Gardiner, Maine.
- 2d.—Escanaba, Michigan; Embarras, Wisconsin.
- 4th.—Nashua, New Hampshire.
- 7th.—Moorhead, Minnesota.
- 12th.—Wellsborough, Pennsylvania.
- 15th.—Sandwich, Illinois.
- 17th.—Gardiner, Maine.
- 20th.—Eastport, Maine.
- 22d.—Bismarck and Fort Totten, Dakota; North Volney, New York.
- 23d.—Bismarck, Dakota.
- 25th.—Fort Totten, Dakota; Helena, Montana.
- 26th.—Poplar River, Montana.
- 28th.—Mackinaw City and Escanaba, Michigan; Nashua, New Hampshire; Embarras, Wisconsin.
- 29th.—Mackinaw City and Escanaba, Michigan.
- 31st.—Delavan, Wisconsin.

ELECTROMETER READINGS.

[Prepared under the direction of Prof. T. C. MENDENHALL, Assistant.]

Observations have been made regularly at 9 a. m., 11 a. m., 1 p. m., and 3 p. m., daily, at the six stations now supplied with electrometers. At Washington City, owing to severity of the weather, observations at the top of the Washington Monument were only made with difficulty. On December 15th, during cold, rainy weather, values were obtained as follows:

Time.	Monument.	Signal Office.	Time.	Monument.	Signal Office.
	Volts.	Volts.		Volts.	Volts.
9 a. m.	+90	+90	12.05 p. m.	125	—72
11 a. m.	—270	—270	12.10 p. m.	225	—36
	—390	—390	12.15 p. m.	225	+6
11.15 a. m.	500		12.20 p. m.	500	+132
11.30 a. m.	1375		12.25 p. m.	450	+48
11.45 a. m.	400		12.30 p. m.	125	+36
12 m.		—228	12.35 p. m.	125	+30

Monument elevation, 500 feet.

Signal Office elevation, 35 feet.

Sparks could be obtained at the Monument by connecting